Supercontinuum Generated by Noise-Like Pulses for Ultrahigh-Resolution Optical Coherence Tomography

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Abstract

In this thesis, an efficient light source for high resolution optical coherence tomography system was designed, constructed and studied. We optimize the characteristics of a supercontinuum light source generated in optical communication single-mode fiber pumped with noise-like pulses. Such kind of pulses can propagate over a long distance in optical fibers while maintaining the packet duration to generate broadband supercontinuum. The center wavelength of the generated supercontinuum is 1060 nm and the FWHM of the output spectrum can exceed 320 nm. We set up a free space Michelson interferometer with both axial and lateral scanning schemes as a prototype time-domain optical coherence tomography system. The experimentally measured point spread function indicates an axial resolution of <5 μm as compared to a theoretical resolution of <1.6 μm.

由似噪音脈衝產生之超連續光譜應用於光學斷層掃描之研究

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中文摘要

在本論文中我們設計並建立了一個高解析度的時域光學斷層掃描系統。光源為似噪脈衝在單模光纖中產生的超連續光譜。似噪脈衝有著穩定的重複率，在次奈秒的波包中有著快且速隨機變化的結構。其寬頻與經過光纖傳遞不易變形的特性可以有利於產生超連續光譜。此光源的中心波長為 1060 奈米，產生的超連續頻譜半高寬可以大於超過 320 奈米，使其在光學斷層掃描中有潛力達到小於 1.6 微米的解析度。我們將本光源利用於包含縱、橫向掃描的自由空間麥可森干涉儀估計光學斷層掃描的解析度。實驗得到的點擴散函數與重建圖顯示本光源之縱向解析度可以小於 5 微米。